REMARKS

In the Office Action, claims 7-8 and 10 were objected. In response, claims 7-8 and 10 have been amended to reflect a change in dependency as previously provided. Therefore, the claim objections should be withdrawn.

In the Office Action, pending claims 6-10 are rejected for alleged anticipation or obviousness in view of the alleged Applicants Admitted Prior Art (APA), alone or in combination with Japanese Patent Publication No. JP 2003111268. Applicants believe that the alleged anticipation and obviousness rejections should be withdrawn at least for the reasons set forth below.

Of the claims at issue, claims 6 and 9 are the sole independent claims. Claim 6 recites a protection circuit for protecting a battery pack having rechargeable batteries connected in series from overcurrents and overvoltages. The protection circuit includes a protection device having a heating resistor and a fuse element provided on a circuit board; and sensing means for detecting an overvoltage across any of the batteries in the battery pack and switching a current flowing into the heating resistor, wherein the fuse element is melted in an overcurrent condition, and in an overvoltage condition on any of the batteries, and wherein the sensing means switches on the current flowing into the heating resistor, thereby causing the heating resistor to generate heat and the fuse element to be melted.

As further supported in the specification, the sensing means senses an overvoltage to switch on a current flowing into the heating resistor of the protection device and apply a voltage to the heating resistor of the protection device. At this time, the sensed voltage is not the voltage of the total number of serially connected batteries in the battery pack but the voltage across any of the serially connected batteries. For this reason, the heating resistor can be shared between a protection device used in a protection circuit for a battery pack having a larger number of serially connected batteries and a protection device used in a protection circuit for a battery pack having a smaller number serially connected batteries. This makes it possible to avoid producing many different protection devices, thereby reducing the manufacturing costs of the protection circuit. Furthermore, according to an embodiment of the protection circuit, a voltage sensing IC having a low voltage rating can detect an overvoltage on a battery pack having a high voltage rating. Here, assuming that the sensed voltage is a voltage across an individual battery between any

batteries, it is possible to observe a charged condition according to a variation in the characteristics of each individual battery in the battery pack. On the other hand, in this protection circuit, a plurality of sensing means can be provided to detect an overvoltage between different batteries in the battery pack. In this case, even when such a voltage sensing IC is not available which has a high voltage rating and detects an overvoltage on the whole battery pack due to its larger number of serially connected batteries, it is possible to form a protection circuit using an existing voltage sensing IC having a low voltage rating corresponding to a battery pack having a smaller number of serially connected batteries. See, Specification, paragraph [0016].

Claim 9 recites a protection circuit for protecting a battery pack having rechargeable batteries connected in series from overcurrents and overvoltages. The protection circuit includes protection devices each having a heating resistor and a fuse element provided on a circuit board; and sensing means for detecting an overvoltage across any of the batteries in the battery pack and switching a current flowing into the heating resistor, wherein the plurality of protection devices are connected in parallel, wherein in an overcurrent condition, the fuse element is melted at each protection device, and wherein in an overvoltage condition on any of the batteries, the sensing means switches on the current flowing into the heating resistor, thereby causing a voltage across a predetermined number of the batteries in the battery pack to be applied to the heating resistor of each protection device, causing the heating resistor to generate heat, and causing the fuse element to be melted.

As further supported in the specification, the protection devices are connected in parallel, and thus the fuse elements are also connected in parallel. For this reason, the fuse element of the protection device can be shared between a protection circuit allowing a larger current to flow through the battery pack and a protection circuit allowing a smaller current to flow through the battery pack, thereby reducing the manufacturing costs of the protection device. Accordingly, the protection circuit can be manufactured at reduced costs as a whole. See, Specification, paragraph [0017].

In contrast as identified in Applicants' description of the prior art, the voltage applied across the heating resistor of the protection device is dependent on the number of serially connected batteries that are included in the battery pack. Accordingly, to ensure that the fuse element of the protection device is melted in an overcharge condition, a lineup of protection

devices has to be prepared each of which is provided with a heating resistor having an appropriate resistance value for each number of serially connected batteries. However, now that battery packs have a variety of voltage ratings for four or less to about ten serially connected lithium-ion batteries, this has become problematic due to an increase in costs or prices resulting from many different protection devices being produced. See, Specification, paragraph [0006].

For example, in the protection circuit 1X of Fig. 6 and a protection circuit 1Y of Fig. 7, if protection devices 2A and 2B each include heating resistors 3 and fuse elements 4 are provided on a circuit board, its operable power is 10 to 20W. One battery 6 within a battery pack 5 has a maximum voltage of 4V, and a voltage sensing IC 8 and an FET 9 are provided as sensing means 7. In this case, the protection devices 2A and 2B have to be prepared such that the heating resistor 3 has the resistance values of Table 1 for each number of serially connected batteries 6 that are included in the battery pack 5. See, Specification, paragraph [0007].

Suppose that in a battery pack 5 having ten serially connected batteries, the protection circuit 1X of Fig. 6 is formed using a 25 Ω heating resistor corresponding to a battery pack 5 having four serially connected batteries. In this case, in an overcharge condition, the voltage sensing IC 8 detects an overvoltage across the battery pack 5 resulting in a change in the gate potential of the FET 9. The power consumption W at the heating resistor 3 when a large current flows through the heating resistor 3 is given by the following equation:

$$W = V \times V/R = 40 \times 40/25 = 64 \text{ W}$$

This thus amounts to 64 W, which is well beyond the operable range of from 10 to 20 W. For this reason, before the fuse element 4 is melted, the heating resistor 3 will burn. See, Specification, paragraph [0008].

As can be seen from the foregoing example, it is necessary to use a heating resistor 3 of the protection devices 2A and 2B that has a resistance value corresponding to the voltage on the battery pack 5. On the other hand, a battery pack used in a mobile electronic device operating on a large current requires the protection device to include a large-current fuse element. From this point of view, a lineup of protection devices with fuse elements of various ratings is required, which has become problematic due to an increase in costs or prices of the protection device. See, Specification, paragraphs [0008] and [0009].

Based on at least these reasons, one skilled in the art would consider that the alleged APA is distinguishable from the claimed invention. Moreover, Applicants do not believe that the secondary reference can be relied on solely to remedy the deficiencies of the alleged APA, assuming that the references are even combinable in the first place.

Accordingly, Applicants respectfully request that the anticipation and obviousness rejections be withdrawn.

The Commissioner is hereby authorized to charge deposit account 02-1818 for any fees which are due and owing.

Respectfully submitted,

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Dated: January 9, 2009